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HUMAN RESOURCES AND THE APPLICATION OF SCIENCE AND TECHNOLOGY IN THE DEVELOPING AREAS

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NOTES

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1. Population Growth in the Developing Areas

About two thirds of the world's people live in the so-called underdeveloped areas and generally, the populations of these areas have increased considerably during the past century. The growth in Asia has been and still is particularly remarkable, but large parts of Latin America, Africa, the Middle East and Southeastern Europe have experienced similar large population increases as well over the past century.

Estimates of the number of people in the main parts of the world since the 18th century show that the growth of population in the underdeveloped areas has occurred mostly in the past century and a half and has been particularly rapid since the beginning of this century. Southeast Asia and Oceania, for instance, gained only 8 million in population between 1700 and 1800, but the increase from 1900 to 1949 was 87 million. The population of the world as a whole increased by about one third from 1850 to 1900 and by more than one half from 1900 to 1949, compared with an increase of roughly one fifth from 1700 to 1750.

Not all the developing areas necessarily have unusually high rates of population increase. But even modest rates, compounded on an already large total, yield alarmingly large absolute increases in population in only a few decades.

This remarkable growth of population in the developing areas in recent times is almost entirely attributable to a decline in death rates. While in many areas of the world death rates are still high compared with the more highly developed countries, they have nevertheless fallen sufficiently in recent decades to cause a substantial population increase.

The decline in death rates in the developing areas, particularly since the beginning of this century, cannot - at least not for the period before 1940 - be attributed to economic development in the popular present-day sense of the term since little of that occurred.

The only plausible explanation seems to be that the increasing contacts of these areas with the Western world directly and indirectly brought about certain changes in these countries which resulted in lower death rates. Some of these changes were due to the spread of colonialism. Others were perhaps direct by-products of economic exploitation in the form of plantations and mining ventures. During the nineteenth century the expansion of the European economy to overseas areas greatly intensified its contacts with these economically underdeveloped areas and many Europeans migrated to these areas to assist in the exploitation of these areas' resources. While this economic penetration had great disruptive effects on the social and economic structure in these areas, it seems to have been primarily responsible for lowering mortality and thus disturbing the population equilibrium in these areas.

In this connection it must be borne in mind that in the wake of the Industrial revolution followed advances in medical science too, so that man could not only be cured from several diseases, but was also able to prevent the occurrence of such diseases. The consequence was a decline in death rates in the Western countries as was indeed evident since the last 150 years.

With the spread of medical science, and especially the introduction

of public health and other sanitation measures to other parts of the world, which went along with Western penetration into these areas, tendencies of declining death rates also began to set in in these areas.

Next to the improvement of public health measures in these areas, two other consequences of the Industrial Revolution must be mentioned which also directly assisted in bringing about a decline in death rates in these areas.

First, due to the Industrial Revolution man was increasingly able to apply his technical knowledge to increase material production, not only food, but also other commodities as well, which eventually resulted in lower prices of commodities and an increase of employment opportunities.

Second, due to the Industrial Revolution and the increase of human knowledge man was also increasingly able to apply new inventions, such as generating power, to other fields like communications and transportation, which thus resulted in a tremendous improvement of communications and transportation in these areas.

These improvements in transportation and communications made the transportation of food stuffs from one area to another area much easier and quicker so that, in most cases, famine could be averted in time.

In addition, cheap transportation made also possible the development of several economic activities in hitherto isolated regions. In this way additional land and natural resources could be used by the population, which thus also contributed to an increase in productivity.

Thus, the remarkable growth in population in the underdeveloped areas from around 1850 till the outbreak of World War II is apparently largely attributable, on the one hand, to the rise in productivity resulting from outside contact and exploitation and, on the other hand, to direct attacks on some of the most important causes of morbidity and mortality.

Evidence is accumulating that the now developing countries can probably lower their mortality rates more rapidly than the now advanced countries did in the past. This fall can be brought about without appreciable improvement in most of the usual economic indices of development. In other words, the rate of decline may be more rapid in the future and it may now be less dependant upon overall economic progress.

The primary reason why further declines in mortality in the developing areas may soon be dramatically rapid is that certain infectious diseases, which are still major scourges in these areas, have been virtually eliminated in the advanced countries by techniques easily, and often cheaply, be transferred to other parts of the world. The developing countries need only the material resources, the trained medical personnel and the requisite administrative efficiency to apply this knowledge on an extensive scale.

Thus, mortality rates in the developing areas can now be reduced very rapidly, and unless comparable declines in birth rates are to be expected, rates of population growth could be dangerously large.

Accordingly, unless an effort equal to that made for the control

of death is made for the control of fertility, and unless a reduction of births is achieved within a few decades, the hopes of the peoples of the developing countries may prove futile, because from the social welfare point of view, the crux of the development problems faced by most of the developing areas is to cause total output to grow faster than population.-

2. Economic Development and the Application of Science and Technology

It has been stated in the preceding paragraph that the rate of population growth has an important bearing on economic development, in that every population increase in a developing country could impede its economic development by swallowing up all the results of increased productivity.

Thus, the crucial problem for the developing countries is to increase, at least to maintain, the rates of technological, economic, and educational growth in excess of the rates of population growth in the developing countries. In other words, to achieve better conditions of life for the peoples in the developing countries, the accelerating of economic development in those countries in excess of population growth is imperative and a substantial increase in productivity in those countries is a principal prerequisite to raising the standards of living of the peoples in those countries.

In our opinion, the key to national prosperity and greater production, apart from the mentality and spirit of the peoples concerned, lies in the effective combination of three highly important factors, namely science and technology, natural resources and capital, of which the first - according to us - is the most important, since the creation and adoption of new scientific techniques can make up for a deficiency in natural resources and reduce the demands on capital. In fact, technology can only grow out of the study of science and its applications.

The outstanding charasteristic of this modern age is the intense cultivation and development of science on a large scale and its application to meet the requirements of the countries concerned. Science and technology can give, and has indeed given, to the majority of the peoples of countries advanced in science and technology a high standard of living and material, social and cultural amenities which in the past was only confined to a priviliged minority of the population.

Science and technology have developed at an ever-increasing pace since the beginning of this century, so that the gap between the advanced and the developing countries has widened more and more.

Accordingly, it is only by adopting the most vigorous measures and by putting their utmost effort into the development of science and technology that this gap between the advanced and the developing countries can be bridged.

In view of the growing importance of science and technology on the prosperity and well-being of the peoples in the developing countries, a well-considered national scientific policy ought, therefore to be one of the most important preoccupations of the govern-

ments of all the countries embarking on their national development effort. In this connection two main lines of action can be sugges ed for the governments of the developing countries, namely the carry ing-out of measures to furnish the necessary resources to develop and further scientific research and secondly, the application of scientific efforts not only to the increase of human knowledge in general, but especially to the economic and social welfare of all the peoples of the developing countries.

In this connection it is also important to bear in mind the highly important role that can be played in this matter by the United Nations and its Specialized Agencies.

It is only by the technical application of all the important results of scientific research that the benefits of the results of that research can be made available to the peoples of the developing countries. In the developing countries a higher standard of living and industrialization - which is a foremost prerequisite to the attainment of prosperity - can only be brought about by vigorous technical efforts which has to be based on all the relevant scientific and technological knowledge gained up until now. These purposeful efforts of harnessing scientific knowledge to a continuous technical effort with the purpose of bringing about specific changes in the methods of work and daily life of the peoples of the developing countries are among the most important and essential necessities of countries in the course of the process of economic development. For the economic progress of a developing country depend on the effective utilization of the human and natural resources of the country through industrialization and modernization of its agriculture.

It must readily be recognized, however, that there are great obstacles to any general technological progress in the developing countries that could well impede economic development. In this connection the lack of expert personnel and the lack of an efficient and effective technical organization can be mentioned as among the more important obstacles. The absorption of new technology in the developing countries is also a very difficult and costly process. Even in the case of relatively simple agricultural improvements there is need for a well-developed administration in government departments of agriculture, well-staffed with experts and technicians and having an extension service that can reach and teach the farmers. In general, it is also urgently necessary for these people to have at least a minimum level of education and literacy in order that widespread advances in technology can be achieved. Accordingly, a whole process of education has to be developed at all levels. Educational institutions have to be built up, without which this whole process cannot be developed and maintained at the proper level of effectiveness. A major obstacle to general technological progress is therefore the lack of an educational and administrative structure through which the producers can learn the new technology.

Education, however, must not be mentioned as merely a process of transmitting techniques, for what is also urgently necessary is a principal change in the outlook of the peoples of these developing countries. For it must be borne in mind that the technological progress in the Western countries is based on a long scientific tradition, a conception of nature leading to a spirit of exploration, discovery and experimentation.

Another important obstacle to the absorption of new technology is the social structure of many developing countries. The peoples of these countries will not be receptive to new technology unless the economic, social and cultural institutions are such as to stimulate individual initiative and incentive. Thus, in most of these countries social reform and a change in outlook are important prerequisites to technological progress.

Another important obstacle to technological progress in the developing countries is the lack of capital, without which technology cannot be utilized or cannot bear full fruits. For it must be kept in mind that technology and capital are joint complementary inputs in the same productive process, the use of either of which necessarily implies the use of the other. Technological progress involves the investment of capital in human beings and in training and teaching them in the new technology, in administrative processes for its transmission, in capital goods - which are in essence the carriers and embodiments of improved technology - and in social and economic overhead capital supporting and developing this whole process.

It must be borne in mind that in many cases the technology of already developed countries cannot be simply transferred to the developing countries, but frequently has to be adapted first to the needs of these latter countries, before it is suitable to them. Thus, considerable sums of money have to be invested in research into the specific needs of the developing countries concerned. Although sometimes this work can be done in the research institutes of developed countries, it is urgently required that many research institutes of this kind be established in the developing countries themselves which could conduct the necessary research to find the most suitable technology for the country concerned.

A problem also necessary to be mentioned here involves the training of higher personnel required to plan and execute economic development. For the time being it is evident that the developing countries will in many cases need to import technical and also administrative staff in many fields. We are of the opinion that in this matter the United Nations and its Specialized Agencies could play a major part next to bilateral agreements between developed and a developing country.

Thus plans for economic development have to start with the establishment and expansion of domestic institutions for training the technical and administrative personnel required at all levels.

Finally, attention has to be paid to the problem of mass education, for in order to secure rapid progress in all fields it is essential to secure the enthusiasm of the peoples of the developing countries for making a real effort toward economic, social and cultural progress.-

3. Upheaval and Adjustment

As stated in the preceding paragraph, technological progress - which is reflected in increasing modernization of agriculture and industrialization - constitutes, in our opinion, the most essential prerequisite towards securing a high standard of living for the peoples of the developing countries.

The process of technological progress , modernization of agriculture and, especially, the process of industrialization involve a process of social and cultural change. For industry represents, in most of the developing countries, a new form of productive organization, essentially foreign or external in origin, and thus involving direct and immediate changes in the pre-existing social structure of these pre-industrial societies. This break-up of the traditional social and cultural patterns is likely to lead to eruption and violence which can be harmful to economic growth.

It must be kept in mind that, in fact, technical change is as old as civilization, and that since time immemorial the ways of life of whole peoples have been transformed by the introduction of new tools and new technical procedures. Relationships between peoples, population balances, dynasties and whole religious systems have been upset by technological changes, just as the inventions and innovations which underlie these technological changes have themselves arisen from changing conceptions of the relation between nature and man. Nor is the attempt to control technological change new; rulers have tried to introduce new practices among their peoples, merchants have attempted to keep within national borders valuable technical processes and conquerors have educated the conquered so that the latter would fit in better within the scheme of conquest.

But what is new is the assumption, also on an international scale, of responsibility for introducing changes which are needed by the peoples in the developing areas which can benefit from the - primarily technical and scientific - knowledge which the peoples of advanced areas have. New also, and this is the most important thing, is the recognition and willingness to deal scientifically with the concomitant effects of such change.

It is, however, known generally that people resist changes that threaten something known, or at least something which has been a part of a known way of life. Therefore, ways of establishing a sense of need must be resorted to before proceeding with the change. The change must point to recognizable advantages; advantages sufficient to outweigh the losses to the people.

Development brings with it a rise of the levels of aspiration among the peoples of the developing countries. Thus, what is now vital to social and political stability is that these development efforts be accompanied by a sense of participation on the part of the peoples in the developing areas, and especially on the part of the individual of these societies. Needed also is a feeling among these people that those aspirations have a prospect of realization. In this connection it is most important that these aspirations of attaining a higher standard of living are not raised to impossible levels.

The people should not fear that the changes are being forced upon them because, in general, people resist forced changes. Ordering people to adopt a new thing or new ways may focus their attention and energies on resisting the command and on efforts to circumvent it, rather than on the advantages of the required change.

In general, it is advisable that, at least in the initial stages, new ideas and practices be introduced as far as possible in the guise of what is already familiar and acceptable.

Lastly, changes should be effected gradually, because all advance needs a stable basis in the peoples of the developing countries and in the social and cultural organization of these societies.-

4. The need for planning

In order to speed up the developmental process, this process has to be an induced and directed rather than a spontaneous, evolutionary process of change. As in most of the developing countries entrepreneurship is weak because the middle-class basis for it is missing, the role of the state is crucial in that it has to step into this vacuum.

The directed process of development entails the deliberate introduction of new equipment and techniques, and the systematic efforts to obtain their widespread, effective operation.

A unique value system, a complicated set of technologies, peculiar ways of life, and special patterning of societal organization run parallel with the introduction of machines and essentially different production techniques are being infused into the lives of the peoples of the developing countries.

Accordingly, a careful culture analysis is preliminary and fundamental to all else.

As stated in the previous paragraph, the growing influence of modern science and technology on the standards of living of all the peoples in the world, especially on those of the developing areas, should make national scientific policy one of the foremost pre-occupations of the governments of these developing countries. The governments of these countries should make it their utmost endeavour that the interaction between the encouragement of science, specifically scientific research, and economic and social progress runs as smoothly as possible to mutual benefit.

Thus, it must be constantly kept in mind that the problem of human resources, that is to say the peoples of the developing countries, and the problem of furtherance of science, especially the application of science and technology, as well as economic growth in itself need an extremely careful analysis and meticulous planning, each in itself as well as in relation to each other, by all the developmental agencies - public as well as private, national as well as international - so as to expedite economic development.-

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